



Figure 3. Example of *resaca* habitat.

Increased municipal and agricultural demands for water have significantly decreased the quantity of water available for refuge wetlands. Additionally, agricultural systems and water-control structures now intercept overland flow that historically inundated much of the river floodplain. Annual average flow in the lower part of the Rio Grande has been reduced by 30 percent to 50 percent by water diversions, and over the past 30 years several fish species have disappeared from the river. Additionally, river-dependent natural stands of plants such as the Sabal Palm and the Montezuma Bald Cypress have been reduced to remnant numbers. Securing adequate water allocation for the management of these wetland and riparian habitats represents a major challenge.



Figure 4. Irrigation return flows.

Water Quality

In addition to reduced water quantities, degraded water quality is a serious concern throughout the Lower Rio Grande Valley subarea. Under-treated sewage, agricultural return flows, and industrial pollution are the most frequently cited concerns. Loss of freshwater flow has exacerbated these pollution problems.

Agricultural chemicals (insecticides, herbicides, and fertilizers) are used year-round in the Lower Rio Grande Valley, and many of these chemicals accumulate in sediment upon reaching aquatic environments 🚚. The Arroyo Colorado and other agricultural drains route potentially harmful amounts of agricultural, municipal, and industrial contaminants to the Laguna Madre, a sensitive, shallow estuary with little water exchange with the Gulf of Mexico. The proximity of agricultural land to refuges in the subarea and the importance of the region as a migratory bird flyway increases the potential for adverse impacts on wildlife. Additionally, irrigation of salt-bearing soil common to the region often results in high dissolved-solids concentration in the return flows. Increased salinity ✳️ in the Rio Grande negatively impacts native fish species 🐟 and contributes to the invasion of exotics, such as the salt-tolerant blue tilapia, which is now the dominant river fish species in the Brownsville area. Increased salinity also threatens use of water resources for agriculture and human consumption. The culture of marine and estuarine organisms, a new and expanding industry in the region, is an additional source of concern in terms of the potential for contaminant and nutrient input to the Arroyo Colorado and the Laguna Madre, as well as the threat of introduction of non-native species and their associated diseases.

The chemical quality of ground water over most of the study area is poor. Dissolved solids usually range from 1,000 to 5,000 mg/l, with sodium, chloride, and sulfate dominating the hydrochemistry. Additionally, high boron and nitrate concentrations appear to be widespread throughout the area. In general, the ground water is unsuitable for irrigation without practicing special agricultural techniques (McCoy, 1990).

Urbanization and economic development 🏠 in the subarea has increased municipal and industrial use of water resources. The increase in industrial activity 🏭 not only increases consumptive use of water, but also raises concerns over aquatic pollution. Heavy metals, industrial solvents, and petroleum products represent common concerns. Additionally, in many areas, water-treatment infrastructure has not kept pace with increased urban growth. The population increase has resulted in expansion of the size and number of unincorporated subdivisions that often lack adequate sewage-treatment systems 🚽.

In addition to the important resources directly associated with the Lower Rio Grande Valley, this subarea also contains two unique coastal resources. The Laguna Madre and Padre Island National Seashore (fig.6) are unique areas that are of major importance to biological diversity. The Laguna Madre of Texas extends the entire length of the South Texas coast from Corpus Christi Bay to the Mexican border. The Laguna is unusual in being one of the few hypersaline lagoon systems in the world. Laguna Madre supports extensive seagrass meadows that are extremely valuable aquatic nursery areas. Additionally, the Laguna Madre in Texas and Tamaulipas provides wintering grounds for 75 percent of the world population of redhead ducks 🦆 (Marc Woodin, USGS,